

8. Watershed-wide Characterization

8.1 Introduction

In addition to the water quality data collected at the paired sites, data was also collected from several other locations throughout the Chorro Creek and Los Osos Creek subwatersheds during 1993-2001. These sampling stations were used to collect watershed-wide data for use in targeting and prioritizing areas for BMP implementation and to monitor various projects that are already occurring throughout the watershed.

Water quality sampling occurred on a weekly basis in the winter and biweekly basis in the summer. Weekly sampling for a 20-week period begins late in the fall, when precipitation increases stream flow at sampling sites. When the 20-week sampling period was not in effect, water quality sampling occurred every other week. The MBVM Program is continuing the data collection through funding by an another Clean Water Act Section 319 Grant.

8.2 Methods

8.2.1 Even-Interval Sampling

Flow rates were measured to better characterize water quality data. Stream flow levels influence water quality parameters through the effects of dilution, erosion, and transport of pollutants. Stream flow data is necessary for hydrologic and water quality modeling of watershed characteristics and pollutant transport.

Flow for Chorro Creek at Canet Road, Los Osos Creek at Los Osos Valley Road, and San Luisito Creek at Adobe Road have been monitored by County Engineering. Flows were also measured by County Engineering at two locations on San Bernardo Creek in the past, but are no longer being monitored. The upper gauging station was destroyed by flooding in winter 1994-95 and the lower gauge is no longer being monitored due to County Engineering budget constraints. The Canet Road gage was taken out in 2001 to improve the creek for fish passage. The County of San Luis Obispo has obtained a grant from the NEP (and elsewhere?) to purchase, install and maintain a new gage. It will be installed in Summer 2002. Stream flow for each of the NMP sampling dates is imputed to correspond with water quality data.

Stream flow data is collected by Regional Board staff and volunteers at selected sampling stations, including Dairy Creek, Pennington Creek, Chumash Creek, and Walters Creek. Additional sites were temporarily monitored for flow at San Bernardo Creek, San Luisito Creek and Chorro Creek near Morro Bay groundwater wells in the Chorro Flats area, using Morro Bay National Estuary Program's volunteer assistance (Regina?). The California Men's Colony supplies release rates for Chorro Reservoir, providing the flow rate for upper Chorro Creek

below the dam. Stream flow is determined for each of the sampling dates in order to correspond with water quality data.

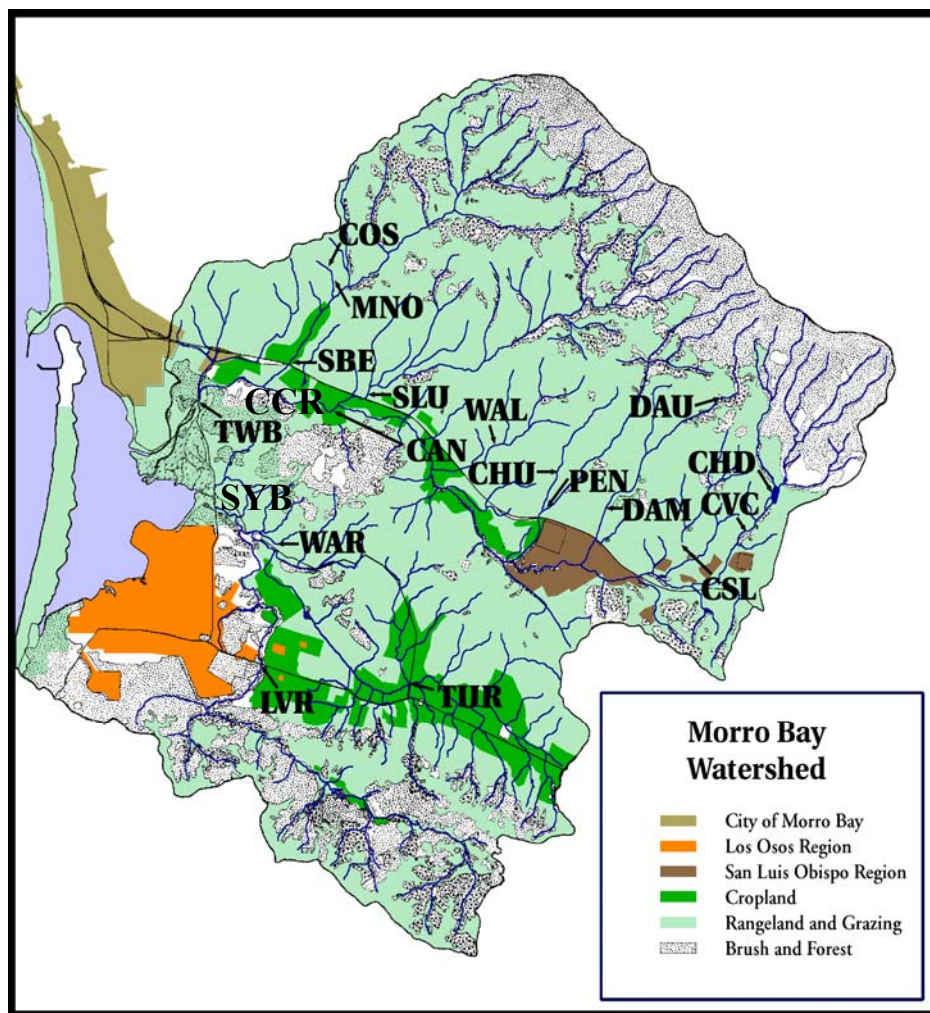
Flow has been modeled for Chorro and Los Osos Creeks by Tetra Tech Inc. as part of the MBNEP Technical Studies. Loading contributions, that consider flow along with concentrations of sediment, nutrients, and bacteria collected as part of the NMP are being determined by the Regional Board for Total Maximum Daily Loads (TMDL) development.

A total of 19 stations were sampled during 1993-2001 throughout the watershed. Many of these stations serve to evaluate BMPs as discussed in previous chapters. Two stations were duplicated during each sampling for quality assurance purposes according to the QAPP (Worcester, et al. 1996). Samples are taken as manual grab samples. Conductivity (mS/cm), pH, water temperature (°C) and dissolved oxygen (mg/L) were measured using a Horiba U-10 Water Quality Checker. Turbidity (NTUs) is measured with a Hach 2100P portable turbidimeter. Air temperature (°C) was recorded at all sample stations. Other water quality parameters were analyzed by the Regional Board contract laboratory according to their approved quality assurance document. Sites are selectively tested for nitrate (mg/L), phosphate (mg/L) and bacteria levels (MPN/100 ml for total and fecal coliform). Suspended sediment samples (g/L) are collected during the 20-week winter sampling period for testing by the Cal Poly Soil Science Department. Samples are analyzed in the same laboratory and by the same protocols used for the Chumash/Walters paired watersheds. Table 8.1 shows parameters measured at each of the NMP sites and Figure 8.1 shows the locations of NMP sites.

Table 8.1 Water quality parameters measured at each of the NMP sites.

| Site | Location | pH | Conductivity | Turbidity | DO | Water Temp | Air Temp | Coliform | Nitrate | Phosphate | Suspended Sediment |
|------|----------------------------------|----|--------------|-----------|----|------------|----------|----------|---------|-----------|--------------------|
| CVC | Upper Chorro Creek | x | x | x | x | x | x | x | x | x | x |
| CHD | Chorro Reservoir | x | x | x | x | x | x | x | | | x |
| CSL | Camp San Luis | x | x | x | x | x | x | x | | | x |
| DAM | Dairy Creek | x | x | x | x | x | x | x | x | x | x |
| DAU | Dairy Creek | x | x | x | x | x | x | x | x | x | x |
| Dup2 | Duplicate | x | x | x | x | x | x | x | x | x | x |
| DAL | Dairy Creek | x | x | x | x | x | x | x | x | x | x |
| PEN | Pennington Creek | x | x | x | x | x | x | x | | | x |
| CHU | Chumash Creek | x | x | x | x | x | x | x | x | x | x |
| WAL | Walters Creek | x | x | x | x | x | x | x | x | x | x |
| CAN | Chorro Creek at Canet Rd. | x | x | x | x | x | x | x | x | x | x |
| Dup3 | Duplicate | x | x | x | x | x | x | x | x | x | x |
| SLU | San Luisito Creek | x | x | x | x | x | x | x | x | x | x |
| SBE | San Bernardo Creek | x | x | x | x | x | x | x | x | x | x |
| MNO | Maino property | x | x | x | x | x | x | | | | x |
| CCR | Lower Chorro Creek | x | x | x | x | x | x | | | | x |
| TWB | Twin Bridges | x | x | x | x | x | x | x | x | x | x |
| SYB | Lower Los Osos Creek | x | x | x | x | x | x | x | x | x | x |
| WAR | Warden tributary | x | x | x | x | x | x | x | x | x | x |
| TUR | Turri Bridge on Warden tributary | x | x | x | x | x | x | x | x | x | x |
| LVR | LOVR on Los Osos Creek | x | x | x | x | x | x | x | x | x | x |

Figure 8.1. National Monitoring Program water quality sites.



8.2.2 Rapid BioAssessment

The two RBA sampling methods which are used in the Morro Bay watershed are “Effect-Based” and “Ambient.” Effect-based sampling is generally used to evaluate the impact of structures or discharges, although it is being applied in BMP treatment areas here. A single, typical riffle in the treatment was sampled at three randomly selected cross-sections. A similar riffle, upstream of the treatment or in the control watershed was sampled as a control. This method of sampling has been applied in the Morro Bay watershed to evaluate BMP implementation projects such as cattle exclusionary fencing on Chorro Creek and Dairy Creek. Ambient sampling was used to characterize the quality of habitat in the watershed. Results are compared to a reference stream. Ambient sampling was conducted by identifying ten consecutive riffles and randomly selecting three riffles, one cross-section sampling collected in each. This method was used in the Los Osos Creek watershed and the Paired watershed.

Pennington Creek, because of its relatively healthy riparian corridor and reduced cattle access, has been used as a reference comparisons to Dairy Creek. Coon Creek in Montana De Oro State Park was evaluated in 1997 as another potential reference stream. Coon Creek lacks agriculture and human impacts other than hiking trails. Its healthy riparian corridor is indicated by a substantially higher habitat score than all other sample sites. RBA protocols are further described in detail in Chapter 3. Paired watershed. Stream Profile Methods are described in Chapter 4. Dairy Creek.

8.3 Results and Discussion

Numerous sites have been monitoring throughout the Chorro and Los Osos watersheds as part of the National Monitoring Program to support various planning and implementation efforts in the watershed.

In 1998, a Stream Flow Study and a Sediment Loading Study (Loading Study) was conducted by Tetra Tech for the Morro Bay National Estuary Program (MBNEP). Tetra Tech developed a computer model for simulation of the rainfall-runoff process within the Morro Bay watershed. The model was created using the U.S. Army Corps of Engineers HEC-1 Flood Hydrograph Package (U.S. Army Corps of Engineers, 1987). The model simulates the runoff response of Chorro and Los Osos Creek to recorded or hypothetical storm events occurring within the watershed. For a given storm event, the model allows peak discharges and/or hydrographs to be generated at 70 different locations within the study basin (Tetra Tech, 1998).

The data base used for development and calibration of the model included topographic maps (U.S. Geological Survey, 1965), soils information from the Soil Survey for San Luis Obispo County (USDA, 1984), historical peak discharge data available at several locations throughout the watershed (San Luis Obispo County Engineering Department, 1988), and the 5-minute rainfall and streamflow records collected in 1995 and 1996 as part of the “paired watershed” study (Morro Bay National Monitoring Program, 1995-96). Tetra Tech used the paired watershed data to develop the relationship of sediment loads to storm runoff and peak flow quantities for individual storm events. Tetra Tech then estimated the results throughout the watershed on the basis of individual sub-basin characteristics and compared the expected concentrations to those measured on Chorro Creek at sites (Hank Felhman, personal communication, 2000). Field reconnaissance and previous studies of watershed characteristics also aided in construction of the model (Tetra Tech, Streamflow Study, 1998).

The MBNEP used the results of these studies and other efforts as a foundation to characterize the Morro Bay watershed, and to prioritize actions in a grass-roots Comprehensive Conservation and Management Plan. NMP data has also been used to develop TMDLs (Total Maximum Daily Loads) for the Morro Bay watershed. These documents are available on the Regional Board website.

The sites that are also locations for BMP analysis are included in this chapter to provide a watershed-wide characterization. Selected sites with their respective land-use, study design, and parameters of interest are discussed below.

In August 1994, the Highway 41 Fire burned 7,524 acres of the upper Chorro Creek and portions of the Dairy Creek, Pennington Creek, San Luisito Creek, and San Bernardo Creek subwatersheds. Because this occurred during the pre-BMP time period for some of the BMP effectiveness projects, conclusions regarding sediment and benthic invertebrate assemblages were difficult to draw. This is discussed in previous chapters.